

INDIANA COUNTY SEAL COAT OPERATIONS

WARD BOND
District Engineer
Asphalt Institute

INTRODUCTION

In order to thoroughly understand proper seal coat application procedures, some basic characteristics of the various asphalt materials are explained. Asphalt is refined from crude oil. The asphalt product most widely used is paving grade or penetration grade asphalt cement. Paving grade asphalt cement is a solid at room temperature and is the basic ingredient of all hot-mix paving materials in this country.

I will not spend much time on the paving grade asphalts, since our interest is with the liquid grades and seal coat procedures. However, individuals who are used to referring to paving grade asphalt as 60-70 or 85-100 penetration will have to change their terminology. The Indiana State Highway Commission, a few years ago, switched to the viscosity grading system which is now used, with few exceptions, throughout the country. At the present time, most of the hot-mix material produced in Indiana is made with AC-20.

LIQUID ASPHALTS—CUTBACKS AND EMULSIONS

Many years ago the asphalt industry decided it would be more convenient to manufacture a product that was liquid at room temperature and, therefore, could be more conveniently applied for its intended use at lower temperatures than the paving grade asphalts. This, of course, is the main reason for the manufacture of the liquid asphalts—cutbacks and emulsions. These materials can be sprayed at temperatures between 100° and 250°. In selecting the type of liquid asphalt to use for seal coat applications, it is quite helpful to know the nature of these materials. The engineer has three basic choices in selection of a liquid asphalt: 1) select the rate of cure which is designated in the case of the cutback asphalts by RC, MC and SC grades (letters designate rapid cure, medium cure, and slow cure). In the asphalt emulsions, the respective designations are RS, MS, and SS; 2) select the desired viscosity to facilitate ease of application; 3) select the desired base asphalt from

which the liquid asphalts are manufactured. This is the residual product that remains on the road surface after the spray application and after the diluent has evaporated from the liquid asphalt.

Cutback Asphalts

In the cutback asphalts, the volatility of the diluent determines the rate of cure, and the quantity of the diluent determines the viscosity of the product.

Asphalt Emulsions

In the case of the emulsions, the diluent being water, the cure-rate is controlled by the formulation of the emulsifying agent. An overly simplified way of looking at an emulsion is to consider the emulsifying agent as forming a protective coating around the finely dispersed asphalt particles that prevents the asphalt particles from coalescing until the emulsion breaks. The emulsifier is formulated to provide less of a protective coating for the more rapid curing grades and a greater protective effect for the slower cures.

ISHC Specifications and Liquid Asphalts

Since the state highway specifications in Indiana only specify RS-2 and the various AE's, which are basically a medium-setting emulsion, we will not be concerned with the SS-emulsion. Neither do the state specifications contain the various cationic emulsions, which are designated by a "C" preceding the grade.

Liquid Asphalts with Hard and Soft Base Asphalts

Concerning the AE-60-90 and 150, the number merely designates the approximate penetration of the base asphalt from which the emulsion is formulated. For example, AE-60 is manufactured using 50-100 penetration asphalt cement. So the choice here is whether one wants a harder or softer base asphalt to remain on the road. The RS-2 is manufactured using approximately the same base asphalt as is used in AE-90.

THE NEW CLASSIFICATION SYSTEM FOR ASPHALTS

A few years ago the asphalt industry proposed a much more efficient, more scientific classification system for cutback asphalts which has now been accepted throughout this country. Some old-timers may recall previous designations using the curing designation followed by 0 through 5 (the higher the number, the greater the viscosity). These designations have been replaced by the new system which uses the designations 70, 250, 800 and 3000. These numbers are simply a better way of design-

nating viscosity (the higher the number, the greater the viscosity), the 3000 grade being quite viscous at room temperatures; the 70 designation being thinner than water at room temperature. These designations have the additional advantage of providing a clearly defined viscosity with sufficient gaps between each designation so that the viscosity characteristics are easily distinguishable. For example, the 250-designation is a product with a viscosity of 250 centistokes through 500 centistokes (double the designated viscosity) with a gap of 300 centistokes between this product and the next most viscous. The 800 designation runs from 800 to 1600 centistokes with a gap before the 3000 designations, etc. This means that one can easily change the desired curing characteristics to facilitate his seal coat operations. For instance, if field crews cannot handle RC-800 before it sets up, change to MC-800 to allow greater handling time, and thereby be sure of retaining the same spraying characteristics, etc.

MOST INDIANA COUNTIES USE MC-800

Since the majority of the counties in Indiana use MC-800, subsequent remarks will concern this product. Some counties are considering changing from cutbacks to emulsions for environmental or energy considerations. My office in Indianapolis will be glad to answer any questions you may have regarding seal coating operations and any problems you have in changing from cutbacks to emulsions, etc., but the manufacturer is your best source of information concerning his product since different processes may be used to produce any given liquid asphalt.

BASIC PRINCIPLES OF SEAL COAT OPERATIONS

Clean Surfaces and Uniform Application

The basic principles to keep in mind in successful seal coat operations are deceptively simple. It goes without saying that the surface must be as clean as possible before applying the liquid asphalt. Power brooms may be used to accomplish this. It is of the utmost importance to use the most efficient means of *uniform* application of the liquid asphalt to the road surface and also *uniform* distribution of the cover material. The foregoing is the most important consideration to produce a good seal coat job.

Methods to Determine Application Rates—Asphalt and Chips

In order to achieve uniform applications, it is necessary to establish a starting point. There are many methods of determining application rates, but the more precise method, which is set forth in our surface

treatment manual, can be easily accomplished through use of an absorptive paper cut to an area of one-square yard and weighing the paper before and after the asphalt application. The application rate of the cover material can also be checked by use of a shallow box or pan, a square-yard in area, and weighing the material after the chip-spreader has passed over it.

Application rate can also be determined by checking the gallons of asphalt and pounds of chips applied to a calculated area of the road surface which may be set up at your convenience. Both of these methods, of course, involve taking the time to calibrate the distributor tank and chip-spreader. These calibrations for the distributor tank should be coordinated with the distributor tachometer. The distributor tank can be calibrated either by the use of a dipstick or by verifying the manufacturer's calibration chart.

Spray Nozzles and Spray Patterns

In order to assure that the equipment continues to apply the asphalt uniformly to the road surface, many common-sense precautions must be observed in the distributor operation. All nozzles must be set at the same angle (usually 30° from the spray bar). Always check for plugged nozzles which are obvious by visual inspection. It is also important to check the spray-pattern. Correct pressure must be maintained at the nozzle, or the spray will either atomize or be too thick, thus causing non-uniform distribution of the asphalt. Proper spraying viscosity can also be controlled by changing the temperature or grade of the asphalt.

Spray Bar Height and Spray Patterns

The height of the spray bar above the road surface is also quite important. If the correct spray-bar height is not maintained, uniform coverage is not assured. If the spray bar is too high, the resulting spray-patterns will overlap. If it is too low, the result will be holidays between adjacent spray-patterns. Both of these conditions will cause streaking of the resulting job. A triple lap spray-pattern may be checked by turning off two adjacent nozzles in each set of three nozzles and noting if this results in a uniform, single lap coverage.

Problems of Incorrect Proportions of Asphalt and Chips

If too much asphalt is applied, the surface will tend to bleed, while if too little asphalt is applied, there will not be enough to properly imbed the chips in the asphalt and retain the cover material. If too much cover material is applied, it will be wasted, as only one layer can be imbedded

in the asphalt. Theoretically, the cover material will contain approximately 50% voids between the aggregate particles when first applied. After having been imbedded in the asphalt and realigned by the roller, the voids will be reduced to approximately 30% and will be further reduced to approximately 20% after compaction under traffic. The objective is to fill approximately 70% of this 20% void-space. Overfilling the voids will cause bleeding; insufficient asphalt will not glue the chips to the road properly.

Correct Proportion of Asphalt and Chips Determined

The correct proportions of asphalt and chips can either be calculated as illustrated in manual MS-13, "Asphalt Surface Treatments," or can be determined experimentally by trial and error. In order to accurately determine this proportion, accurately calibrate the equipment. Allowance must also be made for the condition of the road surface to which the liquid asphalt is applied—a badly weathered surface will require more asphalt than needed for a dense, waterproof surface.

Use of Chip-Spreaders and Tire Rollers Best

From the foregoing remarks, the need for uniform application of the liquid asphalt to the road surface is obvious. As for uniform chip-application, I know no other way this can be accomplished except by a self-propelled chip-spreader. I have never observed even reasonably uniform application from tailgate spreaders, etc. The use of a self-propelled chip-spreader will not, of course, guarantee, of itself, uniform application of cover material. The crews must develop proper operating procedures and obvious common-sense precautions in this phase of the operation. Of utmost importance is the rolling of the chips as soon as possible after application of the asphalt and certainly before the liquid asphalt hardens to the point that it cannot adhere to the chips. The chips must be firmly imbedded in the asphalt within a few minutes after application of the asphalt. The only way this can be properly done is by use of a pneumatic roller—steel wheel rollers tend to bridge or crush the cover material. The flexible pneumatic tires provide the only method of assuring proper imbedment of the chips in the asphalt. The best approach to efficient seal coat operations is a willingness to experiment a bit with various application rates of the asphalt and cover material and to train crews so that they have a thorough understanding of the process involved.

LIMITATIONS OF SEAL COATS AND REFERENCE MANUAL

Obviously a seal coat treatment indiscriminately applied to all roads under your jurisdiction will not solve any of your problems. It must be kept in mind that a seal coat application is a surface treatment and will do no good at all to overcome serious structural defects, such as base failure, characterized by alligator cracking, etc. A careful evaluation of the needs of each section of road must be made in advance of seal coat operations and, for this purpose, the Asphalt Institute has a recent publication, "A Pavement Rating System for Low-Volume Asphalt Roads" (IS-169), available free-of-charge, at your request. It is essential that base-failures be cut out and properly patched and that various other types of failures be properly repaired by skin-patching, etc., before seal coat operations begin. Along this line, I recommend two of our manual series: "Asphalt Surface Treatments" (MS-13) and "Asphalt In Pavement Maintenance" (MS-16), which thoroughly cover seal coat operations and maintenance.

CONTACT ASPHALT INSTITUTE FOR HELP

The Asphalt Institute is here to help in any way we can to assure that you obtain the best possible job when you use asphalt. By proper use of the various asphalt products, we feel sure that you will be satisfied that you have obtained the best and most economical results from the investment of your road maintenance dollar.

